

I CLAIM:

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1. A method of validating a connection mapped through a communications network between first and second end-nodes, the method comprising the steps of:
 - a) at the first end-node, inserting performance monitor (PM) information into a predetermined location within a payload portion of a payload envelope;
 - b) transporting the payload envelope through the connection to the second end-node; and
 - c) at the second end-node, extracting the PM information from the predetermined location within the payload envelope.
 2. A method as claimed in claim 1, wherein the payload envelope is an augmented synchronous payload envelope (SPE) having a payload capacity sufficient to accommodate the PM information.
 3. A method as claimed in claim 2, further comprising a step of converting a SONET/SDH SPE into the augmented SPE.
 4. A method as claimed in claim 3, wherein the step of converting the SONET/SDH SPE comprises a step of increasing a size of the SONET/SDH SPE by an amount sufficient to accommodate the PM information.
 5. A method as claimed in claim 2, further comprising a step of enabling the first and second nodes to pointer process the augmented SPE.

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- A method as claimed in claim 5, further comprising a step of providing an extended range of valid payload pointer values that can be pointer processed within a node participating in the connection.
7. A method as claimed in claim 1, wherein each node in the network is adapted to support a plurality of connection layers and the connection is mapped on one of the plurality of connection layers.
 8. A method as claimed in claim 7, wherein PM information respecting each layer is inserted into a respective predetermined location of the payload envelope.
 9. A method as claimed in claim 1, wherein the step of inserting PM information comprises a step of inserting one or more of a Trace field; a Parity field; and an indicator field.
 10. A method as claimed in claim 9, wherein the step of inserting a Trace field comprises inserting a nibble of a trace message for communicating information concerning the connection.
 11. A method as claimed in claim 10, wherein the step of inserting the nibble of a trace message comprises a step of inserting successive nibbles of the trace message into respective successive signals until an entire trace message has been sent.
 12. A method as claimed in claim 10, wherein the step of inserting a Trace field comprises repeating the trace message after the entire trace message has been sent.

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13. A method as claimed in claim 9, wherein the step of inserting a parity field comprises a step of calculating a parity value in respect of a data signal, and inserting the parity value into a next augmented SPE to be transmitted.
14. A method as claimed in claim 13, wherein the parity value is a BIP-8.
15. A method as claimed in claim 14, wherein the parity value is calculated starting after an H2 byte of a transport overhead (TOH) portion of the signal, and incorporates all payload envelope bytes until the H2 byte of a next data signal.
16. A method as claimed in claim 9, wherein the step of inserting an indicator field comprises a step of accumulating an error count in respect of the data signal.
17. A method as claimed in claim 16, wherein the error count is a BIP-8.
18. A method as claimed in claim 1, wherein the step of extracting the PM information comprises a step of extracting one or more of a trace field; a parity field; and an indicator field.
19. A method as claimed in claim 18, further comprising a step of converting the payload envelope into a SONET/SDH SPE having a conventional size and format.
20. A method as claimed in claim 18, wherein the step of extracting a parity field further comprises a step of

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calculating a parity value in respect of the received data signal.

21. A method as claimed in claim 20, further comprising a step of comparing the recalculated parity value with a received parity value contained in the extracted parity field to obtain an error count.
22. A method as claimed in claim 21, further comprising a step of accumulating the error count value in respect of the received data signal.
23. A method as claimed in claim 18, wherein the step of extracting an indicator field further comprises the steps of:
 - a) monitoring the indicator field of each successive received data signal; and
 - b) asserting an AIS state if the indicator field of each of a first predetermined number of successive data signals contains a first predetermined value.
24. A method as claimed in claim 23, further comprising a step of de-asserting the AIS state if the indicator field of each of the first predetermined number of successive data signals contains a value other than the first predetermined value.
25. A method as claimed in claim 23, wherein the first predetermined number of successive data signals is three.

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26. A method as claimed in claim 23, wherein the first predetermined value is binary "1111".
27. A method as claimed in claim 18, wherein the step of extracting an indicator field further comprises the steps of:
- a) monitoring the indicator field of each successive received signal; and
 - b) asserting an RDI state if the indicator field of each of a second predetermined number of successive signals contains a second predetermined value.
28. A method as claimed in claim 27, wherein the predetermined number of successive data signals is three.
29. A method as claimed in claim 27, wherein the second predetermined value is binary "1100".
30. A system of validating a connection mapped through a communications network between first and second end-nodes, the system comprising:
- a) means for inserting performance monitor (PM) information into a predetermined location within a payload envelope at the first end-node;
 - b) means for transmitting the payload envelope through the connection to the second end-node; and
 - c) means for extracting the PM information from the payload envelope at the second end-node.

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31. A system as claimed in claim 30, wherein the payload envelope is an augmented synchronous payload envelope (SPE) having a payload capacity sufficient to accommodate the PM information.
32. A system as claimed in claim 31, wherein each of the first and second nodes comprise a respective pointer processor state machine adapted to control pointer processing of the augmented SPE.
33. A system as claimed in claim 32, wherein each pointer processor state machine is adapted to accommodate an extended a range of valid payload pointer values, relative to a that of the SONET/SDH SPE standard.
34. A system as claimed in claim 30, wherein each node in the network is adapted to support a plurality of connection layers and the connection is mapped on one of the plurality of connection layers.
35. A system as claimed in claim 34, wherein PM information respecting each layer is inserted into a respective predetermined location of the payload envelope.
36. A system as claimed in claim 30, wherein the PM information comprises any one or more of a Trace field; a Parity field; and an Indicator field.
37. A system as claimed in claim 36, wherein the Trace field contains a nibble of a trace message for communicating information concerning the connection.

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38. A system as claimed in claim 37, wherein successive nibbles of the trace message are inserted into respective successive synchronous containers until an entire trace message has been sent.
39. A system as claimed in claim 37, wherein the trace message is repeated after the entire trace message has been sent.
40. A system as claimed in claim 36, further comprising
 - a) means for calculating a parity value in respect of a data signal; and
 - b) means for inserting the parity value into the parity field of a next synchronous container to be transmitted.
41. A system as claimed in claim 40, wherein the parity value is a BIP-8.
42. A system as claimed in claim 41, wherein the parity value is calculated starting after an H2 byte of a transport overhead (TOH) portion of the signal, and incorporates all payload envelope bytes until the H2 byte of a next data signal.
43. A system as claimed in claim 36, wherein the indicator field contains an error count accumulated in respect of the data signal.
44. A system as claimed in claim 43, wherein the error count is a BIP-8.
45. A system as claimed in claim 30, wherein the means for extracting the PM information comprises means for

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extracting one or more of a trace field; a parity field; and an indicator field.

46. A system as claimed in claim 45, wherein the means for extracting a parity field further comprises means for calculating a parity value in respect of the received data signal.
47. A system as claimed in claim 46, further comprising means for comparing the recalculated parity value with a received parity value contained in the extracted parity field to obtain an error count.
48. A system as claimed in claim 47, further comprising means for accumulating the error count value in respect of the received payload envelope.
49. A system as claimed in claim 45, wherein the means for extracting an indicator field further comprises:
- a) means for monitoring the indicator field of each successive received payload envelope; and
 - b) means for asserting an AIS state if the indicator field of each of a first predetermined number of successive payload envelope containers contains a first predetermined value.
50. A system as claimed in claim 49, further comprising means for de-asserting the AIS state if the indicator field of each of the first predetermined number of successive payload envelope contains a value other than the first predetermined value.

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51. A system as claimed in claim 49, wherein the first predetermined number of successive payload envelope is three.
52. A system as claimed in claim 49, wherein the first predetermined value is binary "1111".
53. A system as claimed in claim 45, wherein the means for extracting an indicator field further comprises:
 - a) means for monitoring the indicator field of each successive received payload envelope; and
 - b) means for asserting an RDI state if the indicator field of each of a second predetermined number of successive signals contains a second predetermined value.
54. A system as claimed in claim 53, wherein the predetermined number of successive payload envelopes is three.
55. A system as claimed in claim 53, wherein the second predetermined value is binary "1100".
56. An apparatus for validating a connection mapped through a communications network between first and second end-nodes, the apparatus comprising:
 - a) means for inserting performance monitor (PM) information into a predetermined location within a payload envelope; and
 - b) means for transmitting the payload envelope through the connection.

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57. An apparatus as claimed in claim 56, wherein the payload envelope is an augmented synchronous payload envelope (SPE) having a payload capacity that is sufficient to accommodate the PM information.
58. An apparatus as claimed in claim 57, wherein each of the first and second nodes comprise a respective pointer processor state machine adapted to control pointer processing of the augmented SPE.
59. An apparatus as claimed in claim 58, wherein each pointer processor state machine is adapted to accommodate an extended range of valid payload pointer values, relative to a that of the SONET/SDH SPE standard.
60. An apparatus as claimed in claim 56, wherein each node in the network is adapted to support a plurality of connection layers and the connection is mapped on one of the plurality of connection layers.
61. An apparatus as claimed in claim 60, wherein PM information respecting each layer is inserted into a respective predetermined location of the payload envelope.
62. An apparatus as claimed in claim 56, wherein the PM information comprises any one or more of a Trace field; a Parity field; and an Indicator field.
63. An apparatus as claimed in claim 62, wherein the Trace field contains a nibble of a trace message for communicating information concerning the connection.

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64. An apparatus as claimed in claim 63, wherein successive nibbles of the trace message are inserted into respective successive payload envelope until an entire trace message has been sent.
65. An apparatus as claimed in claim 63, wherein the trace message is repeated after the entire trace message has been sent.
66. An apparatus as claimed in claim 65, further comprising
- a) means for calculating a parity value in respect of a data signal; and
 - b) means for inserting the parity value into the parity field of a next payload envelope to be transmitted.
67. An apparatus as claimed in claim 66, wherein the parity value is a BIP-8.
68. An apparatus as claimed in claim 66, wherein the parity value is calculated starting after an H2 byte of a transport overhead (TOH) portion of the signal, and incorporates all payload envelope bytes until the H2 byte of a next data signal.
69. An apparatus as claimed in claim 62, wherein the indicator field contains an error count accumulated in respect of the data signal.
70. An apparatus as claimed in claim 69, wherein the error count is a BIP-8.

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Sub A³ 71. An apparatus for validating a connection mapped through a communications network between first and second end-nodes, the apparatus comprising:

- a) means for receiving a payload envelope through the connection; and
- b) means for extracting performance monitor (PM) information from a predetermined location within a payload envelope.

72. An apparatus as claimed in claim 71, wherein the means for extracting PM information comprises means for extracting one or more of a trace field; a parity field; and an indicator field.

73. An apparatus as claimed in claim 72, wherein the means for extracting a parity field further comprises means for calculating a parity value in respect of the received payload envelope.

74. An apparatus as claimed in claim 73, further comprising means for comparing the recalculated parity value with a received parity value contained in the extracted parity field to obtain an error count.

75. An apparatus as claimed in claim 74, further comprising means for accumulating the error count value in respect of the received payload envelope.

76. An apparatus as claimed in claim 72, wherein the means for extracting an indicator field further comprises:

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81. An apparatus as claimed in claim 80, wherein the predetermined number of successive payload envelope is three.
82. An apparatus as claimed in claim 80, wherein the second predetermined value is binary "1100".

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